



A.D. 1833 . . . . . N<sup>o</sup> 6458.

S P E C I F I C A T I O N

OF

WILLIAM WIGSTON.

APPARATUS APPLICABLE TO FURNACES  
FOR CONSUMING SMOKE.

L O N D O N :

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**Apparatus applicable to Furnaces for Consuming  
Smoke.**

**WIGSTON'S SPECIFICATION.**

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM WIGSTON, of Salford, in the County of Lancaster, Civil Engineer, send greeting.

WHEREAS His present most Excellent Majesty King William the Fourth,  
5 by His Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twelfth day of August, in the fourth year of His reign, did, for Himself, His heirs and successors, give and grant unto me, the said William Wigston, His especial license, full power, sole privilege and authority, that I, the said William Wigston, my executors, administrators, and assigns, or  
10 such others as I, the said William Wigston, my executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, my Invention of "CERTAIN IMPROVEMENTS  
15 IN APPARATUS FOR CONSUMING SMOKE, WHICH IMPROVEMENTS ARE APPLICABLE TO THE FURNACES OF STEAM BOILERS AND TO FURNACES CONSTRUCTED FOR OTHER PURPOSES;" in which said Letters Patent is contained a proviso, that I, the said William Wigston, shall cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, to be inrolled  
20 in His Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.



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**NOW KNOW YE**, that in compliance with the said proviso, I, the said William Wigston, do hereby declare the nature of my Invention of "Certain Improvements in Apparatus for Consuming Smoke, which Improvements are applicable to the Furnaces of Steam Boilers and to Furnaces constructed for other Purposes," to consist in the construction and arrangement of certain 5 apparatus for the purpose of regulating the supply of atmospheric air to furnaces of steam boilers, and to furnaces constructed for other purposes, by means of which the smoke is consumed, without materially affecting the regular draft or current of air by which the combustion of the fuel in such furnaces is maintained; and the manner in which the same is to be performed 10 and carried into effect will be more clearly seen by reference to the annexed Drawings, in all which, various views and sections, letters and figures of reference, are used, the same letters and figures of reference denoting the same parts throughout the whole of the Drawings. But before I commence my description of the annexed Drawing I shall briefly describe the action of 15 atmospheric air in consuming the smoke of furnaces, and the objections to the admission of atmospheric air for this purpose, which objections it is the object of my Invention to remove. The supply of atmospheric air which passes through the bars of a furnace for heating boilers or similar purposes depends on the power of the chimney, size of flues, and other circumstances; but let this be 20 arranged as it may, and effectual draft for a fire in a state of active combustion, which proves quite sufficient for its support, will not be found sufficient when fresh fuel is added to the furnace; and hence, a considerable portion of the vapour and gas which is disengaged from the coal, together with small particles of carbon, are carried up the chimney in the form of smoke. Various con- 25 trivances have been applied for obviating the nuisance arising from the smoke of furnaces of this description, the most successful of which have consisted either in supplying the fresh coal in small quantities, so that the combustion was more rapid and effectual, or in supplying the furnace with an additional current of atmospheric air at the period at which the fresh coal was placed on 30 the furnace. This latter method of consuming the smoke by the admission of atmospheric air has been long practiced; but as it is only required at the period at which the fresh fuel is placed on the furnace, any neglect of the servant or fireman who attends to the furnace may allow the additional supply of atmospheric air for consuming the smoke to continue longer than required, or limit 35 the admission of air, when it is required. This neglect would either create smoke, for want of a supply of air, or, after the smoke is consumed, let down the temperature of the furnace, by a superabundance of cold air going into the furnace when it was not required. These objections, which entirely depend



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on the attention of the servant or operative, it is the object of my Invention to remove beyond his care, so that he cannot proceed to supply his furnace with fuel without bringing into action the smoke-consuming apparatus, which supplies the required amount of atmospheric air to consume the smoke, and  
5 no more.

## DESCRIPTION OF THE DRAWING.

Figure 1 represents a longitudinal section of a steam boiler and furnace to which my improved apparatus for consuming smoke is applied. In this Figure, A represents the boiler; B, the furnace; *a, b, b, b*, the flue, the course  
10 of the smoke being shewn by the direction of the black arrows towards the chimney C. D represents an air chamber for the purpose, containing a quantity of air, which is heated by its contiguity to the furnace B, so that when air is admitted from this chamber to the furnace, for the purpose of consuming the smoke, it goes into the furnace at a considerably higher temperature than  
15 the surrounding atmosphere. This chamber D is connected with the external atmosphere by the air flue *d, d, d*, which can be opened or shut by elevating or depressing the cone E. This cone is suspended from a rod or chain attached to its point or apex, which when sufficiently elevated completely shuts the circular opening by which the air flue *d, d, d*, is supplied from the external  
20 atmosphere. Now, supposing the supply of air to the chamber D to be cut off by elevating the cone E, and the fuel in the furnace to be ignited, the smoke from the furnace would proceed through the flues *b, b, b*, and up the chimney C, in the usual manner; but as soon as the cone E is depressed, so as to allow a fresh supply of air to rush into the chamber D, the heated air  
25 which it has before contained will flow out at the horizontal opening, indicated by the red arrow, and thereby supply the furnace with the additional quantity of air required for the combustion of the gas and carbonaceous matter contained in the smoke. As already explained, the extra supply of air is requisite while the smoke exists, but would be detrimental as soon as the furnace  
30 became clear, so that it is requisite to the complete action of this apparatus that the cone E gradually shut off the supply as the smoke gradually decreases, which, together with the depressing of the cone for the purpose of opening the flue when the fresh fuel is placed on the surface, I effect in the following manner:—Figure 4 represents an enlarged section of the cone E, and ap-  
35 paratus by which its position is regulated. In this Figure F represents an inverted vessel similar to a gas-holder, and *f, f, f, f*, a metallic tank partly filled with water, the surface of which is shewn by the horizontal dotted line. The vessel F is suspended by the same rod or chain which supports the cone E,



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the upper part of which chain passes over pulleys G, G, as seen at Figures 1 and 2; and the cone E, along with the vessel F, are held at their greatest elevation by a counterweight *g*, attached to the opposite extremity of the chain which supports them. At the top of the vessel F is placed the stop-cock H and an hydraulic valve I, the construction of which will be seen at Figure 4, where the water line which seals the joint is shewn in dotted lines, and a spiral spring for the purpose of assisting in the opening of the valve is delineated. By referring to Figure 2, it will be observed, that the counterweight *g*, which supports the cone E and vessel F, rests on the tail end of a small lever *h*, which forms part of a toothed sector vibrating on a common centre <sup>1</sup>*h*. This toothed sector gears into another bevil sector, which is cast upon the face, and forms part of the door K of the furnace. Thus it is impossible for the fireman to open the furnace door for the purpose of adding fresh fuel, which would generate smoke in ordinary furnaces, without vibrating the lever *h*, which elevates the counterweight *g* and depresses the cone K and inverted vessel F; the depressed cone K allowing air to flow into the chamber D, and thence into the furnace, as already described, and the hydraulic valve I allowing the air contained in the upper part of the vessel F to escape at the same time. In this position, it is clear that the vessel F and cone K cannot rise to shut off the supply of air to the chamber D, without at the same time overcoming the atmospheric pressure on the upper surface of the vessel F, for which the weight *g* is not sufficient. It is therefore necessary to adjust the opening of the cock H that the requisite supply of air to the interior of the vessel F may be admitted, and the gradual elevation and gradual closing of the circular opening for admitting air to the flue *d, d, d*, by means of the cone E be regulated. The period of time required for the complete consumption of the smoke caused by a fresh supply of fuel to the furnace will be ascertained by a little experience, and it is only required to adjust the cock H, so that the rising of the cone E and the shutting off the supply of air to the chamber D terminate at the same time as the smoke ceases to be created. The cock H being properly adjusted, the key by which it is adjusted may be removed, so that the fireman has no controul over the apparatus. There is a short space of time between the fireman opening the furnace door and putting on the fuel, in which the admission of air from the chamber D is not required; and although this is not of any great importance, it may be obviated by the arrangement shewn at Figure 3, where the cone and vessel F are suspended from a lever L, which vibrates on its centre *l*. From the opposite end of this lever L, to which the cone is suspended, is placed a perpendicular bar M, having a joint opening outwards at *m*. In this arrangement,



FIG. 1.

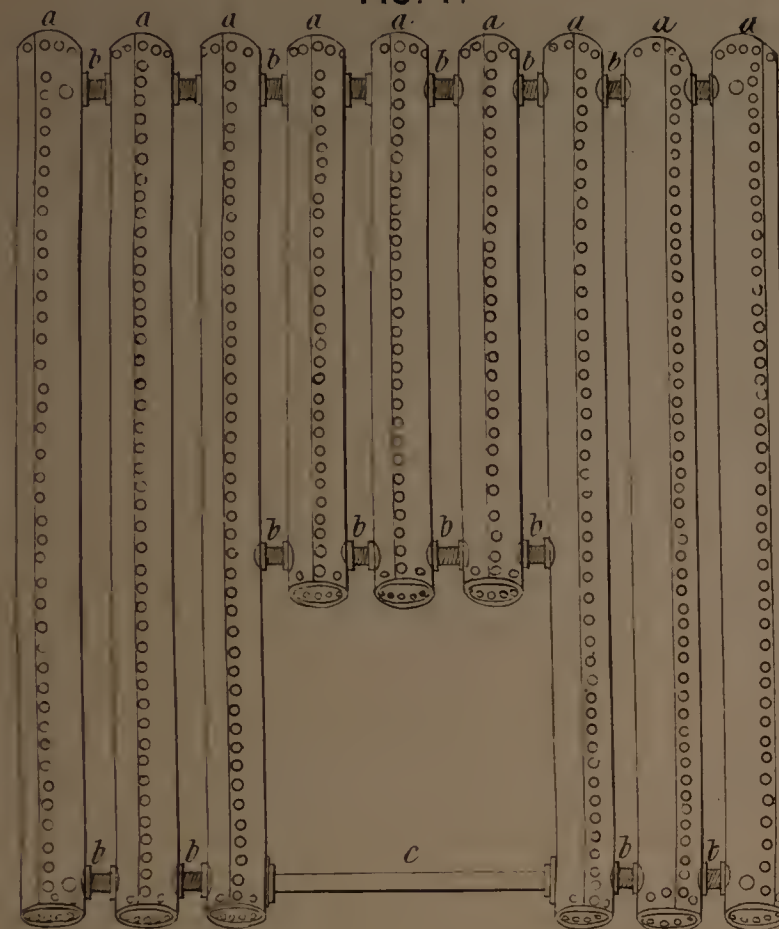


FIG. 3.

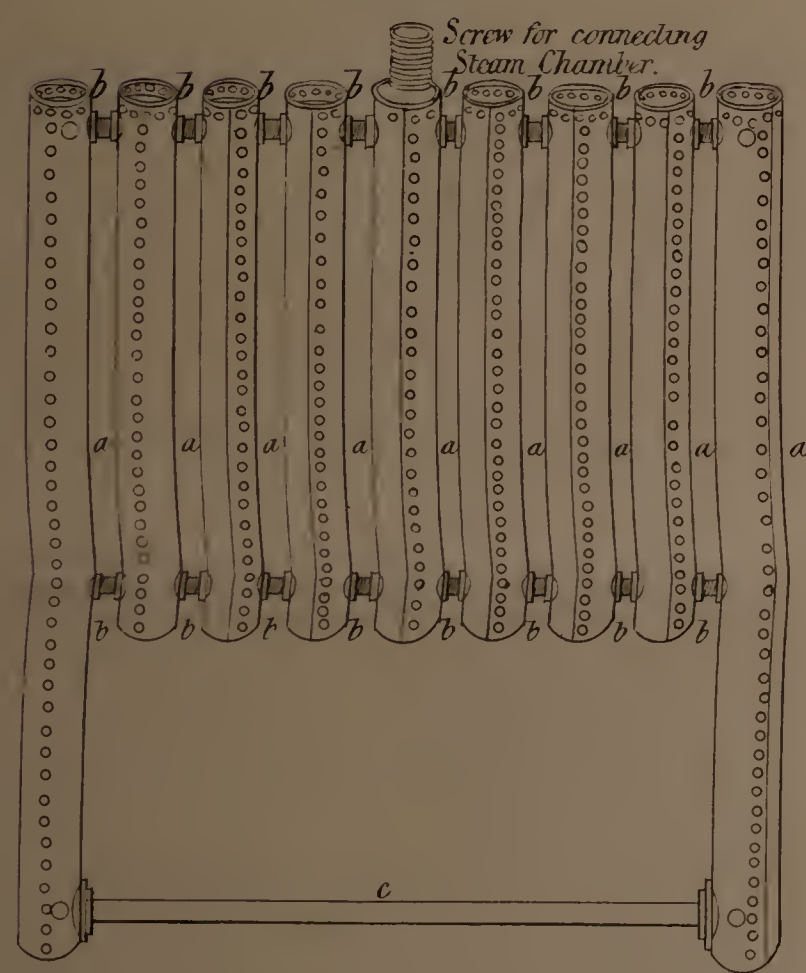


FIG. 4.

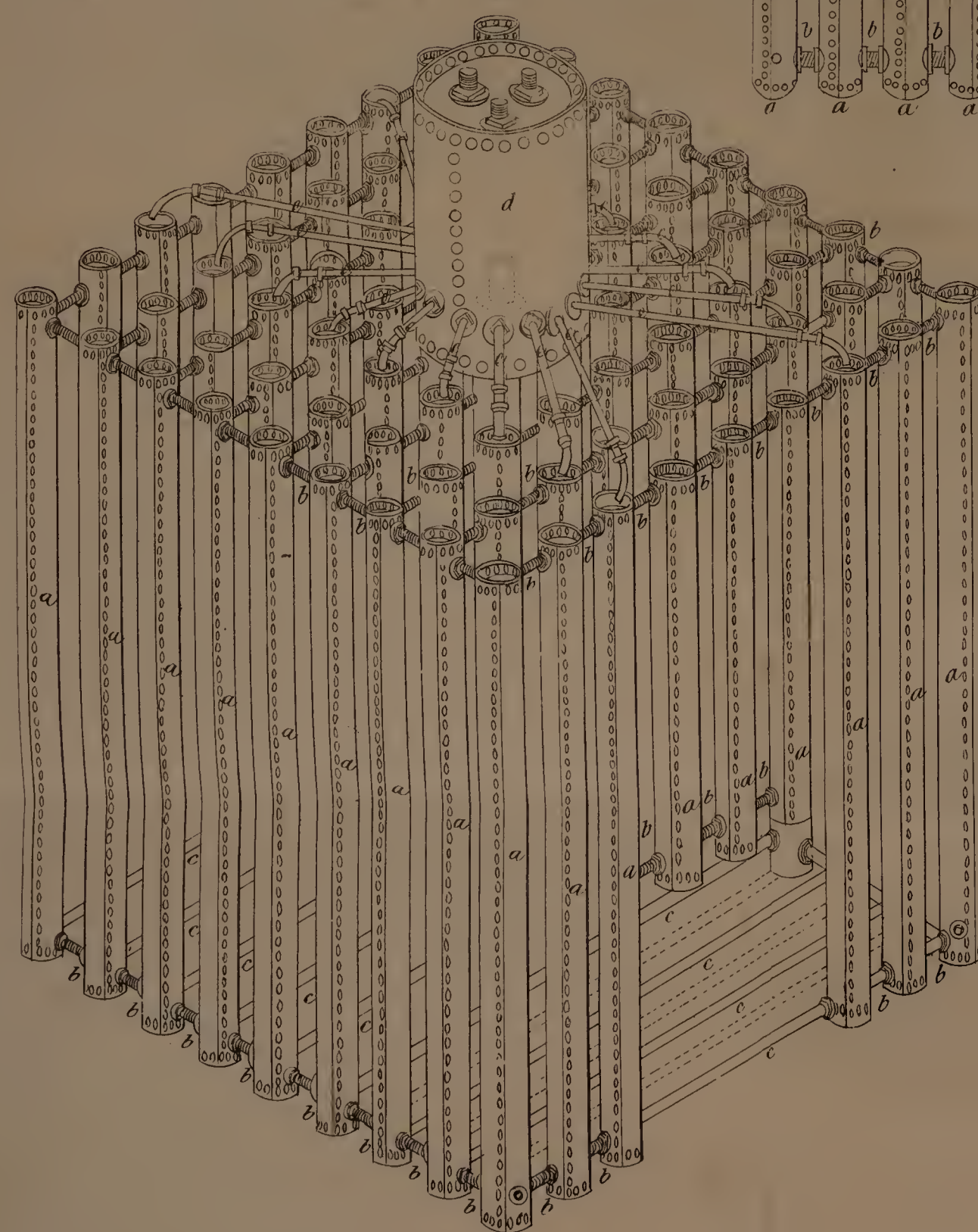


FIG. 2.

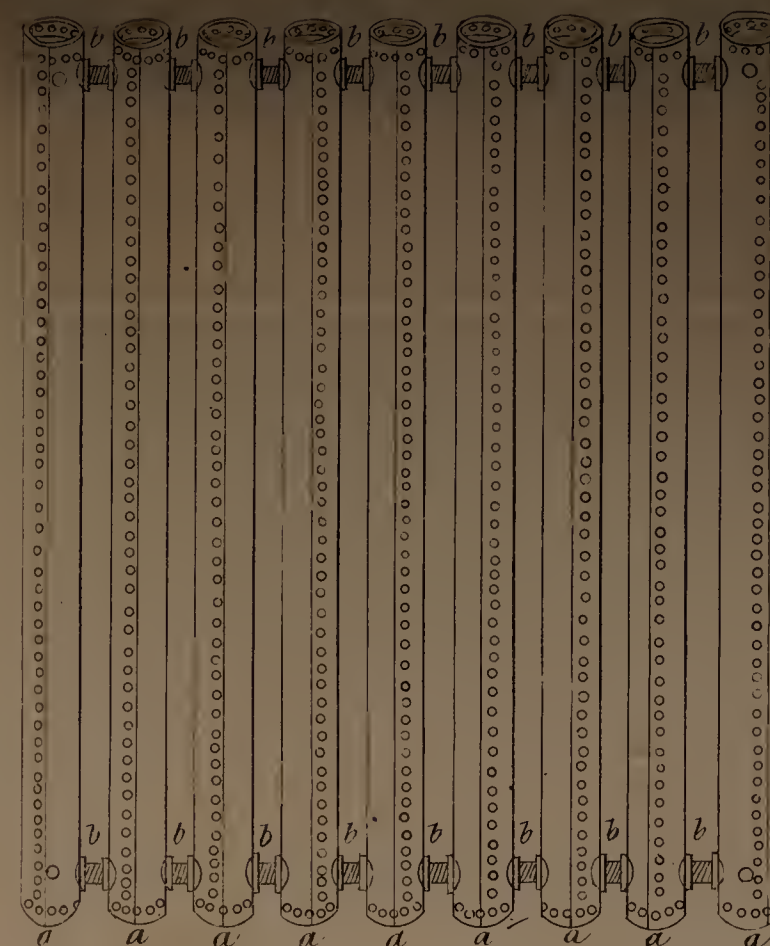
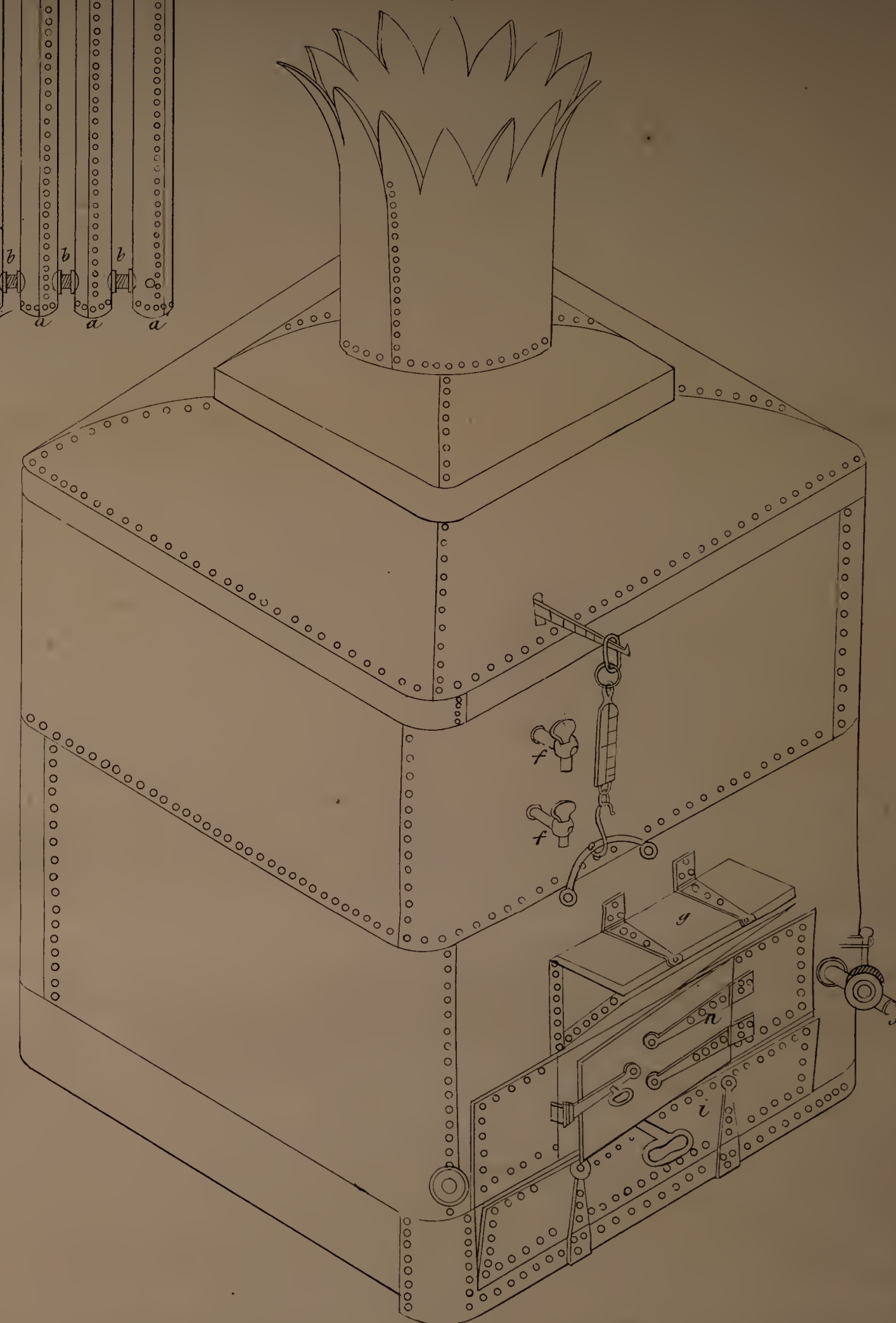


FIG. 5.



The enrolled drawing is colored.





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when the fireman opens the fire door the small projection from upper edge of the door, as shewn in the Drawing, bends the bar at M at the joint *m*, which again falls into its perpendicular position as soon as the door is wide open, without affecting the cone E in any way; but as soon as the fireman has  
5 placed the fuel on the furnace he cannot shut the door without removing the lower part of the bar M, which he elevates by hand, and thus depresses the opposite end of the lever L and the cone E, producing similar effects at those already described in the former arrangement. In the apparatus already described for regulating the motion of the cone E, the variation of speed is  
10 wholly dependent on the adjustment of the cock H, by which the air is admitted into the vessel F; but a similar effect may be produced by the apparatus shewn at Figure 5. In this Figure, N represents a vessel open at the top, and having two large valves opening inwards, as seen also in plan at Figure 6; this vessel N is placed in a tank of water, similar to *ff*, *ff*, and  
15 suspended by the rod and counterweight, in every respect similar to the inverted vessel F, already described. Now, as soon as the fire door is opened and the vessel N depressed, in the manner already described, the water in the external tank *ff*, *ff*, will flow in by the two valves in the bottom of the vessel N; and the progressive rise of this vessel for the purpose of regulating the  
20 cone motion is adjusted by the opening of cock O, which allows the water to flow out at any speed which may be required, and thereby regulates the motion of the cone beneath, which is connected, as already described. The duration of the supply of air to the furnace in both the arrangements already described depends on the adjustment of the cocks H and O, the counterweight *q* being  
25 always the same; but it is equally susceptible of variation by varying the shape of the cone itself, which being formed more taper, or having its upper part cylindrical, would vary the amount of air admitted, as well as the period of its duration; but these variations of construction must depend on the nature of the furnace to which my Invention is to be applied. I prefer the cone form,  
30 from its property of regularly decreasing the amount of air admitted to the furnace as the smoke to be consumed decreases; this as well as other minor arrangements must depend on the judgment of the parties who apply my Invention. For applying my Invention to furnaces, in which the supply of fuel depends on a feeding apparatus attached to an engine or other moving power,  
35 I make the opening action of the cone E dependent on the strap or moving power which drives the feeding apparatus, so that as soon as the supply of fuel commences, the cone is depressed, and the supply of air commences; but as soon as the feeding ceases, the supply of air gradually decreases also. The application of my Invention to furnaces supplied with fuel by apparatus of this



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nature enables me to keep more fuel on the bars of the furnace without the fear of creating smoke, and thereby renders the heat generated more regular than is usual in furnaces fed by machines.

Having described the nature and construction of my certain improvements in apparatus for consuming smoke, I hereby declare that I do not claim any 5 separate or well-known part of such apparatus; but I do claim as of my Invention that arrangement of parts, as herein-before described, by which the requisite supply of air is regulated for consuming the smoke of furnaces simultaneously with the feeding of the furnace or the supply of fuel, which causes the production of the smoke; and such my Invention being, to the best of my 10 knowledge and belief, entirely new and never before in use in that part of His said Majesty's United Kingdom of Great Britain and Ireland called England, His Dominion of Wales, and Town of Berwick upon Tweed, I do hereby declare this to be my Specification of the same; and that I do verily believe this my said Specification doth comply in all respects fully and without 15 reserve or disguise with the proviso in the said herein-before in part recited Letters Patent contained; therefore I do hereby claim to maintain exclusive right and privilege of my said Invention.

In witness whereof, I, the said William Wigston, have hereunto set my hand and seal, the Eighth day of February, in the year of our Lord 20 One thousand eight hundred and thirty-four.

WM (L.S.) WIGSTON.

Signed, sealed, and delivered by the said

William Wigston, in the presence of

WILLIAM NICHOLSON.

25

**AND BE IT REMEMBERED**, that on the Eighth day of February, in the fourth year of the reign of His Majesty King William the Fourth, the said William Wigston came before our said Lord the King in His Chancery, and acknowledged the instrument aforesaid, and all and everything therein contained and specified, in form above written. And also the instrument aforesaid 30 was stamped according to the tenor of the Statute made in the fifty-fifth year of the reign of His late Majesty King George the Third.

Inrolled the Eleventh day of February, One thousand eight hundred and thirty-four.

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